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ABSTRACT

This student module on safety features of material and personnel movement devices is one of 50 modules concerned with job safety and health. This module covers safe conditions and operating practices for conveyors, elevators, escalators, moving walks, manlifts, forklifts, and motorized hand trucks. Following the introduction, 10 objectives (each keyed to a page in the text) the student is expected to accomplish are listed (e.g., List six main operating rules of a manlift). Then each objective is taught in detail, sometimes accompanied by illustrations. Learning activities are included. A list of references and answers to learning activities complete the module. (CT)

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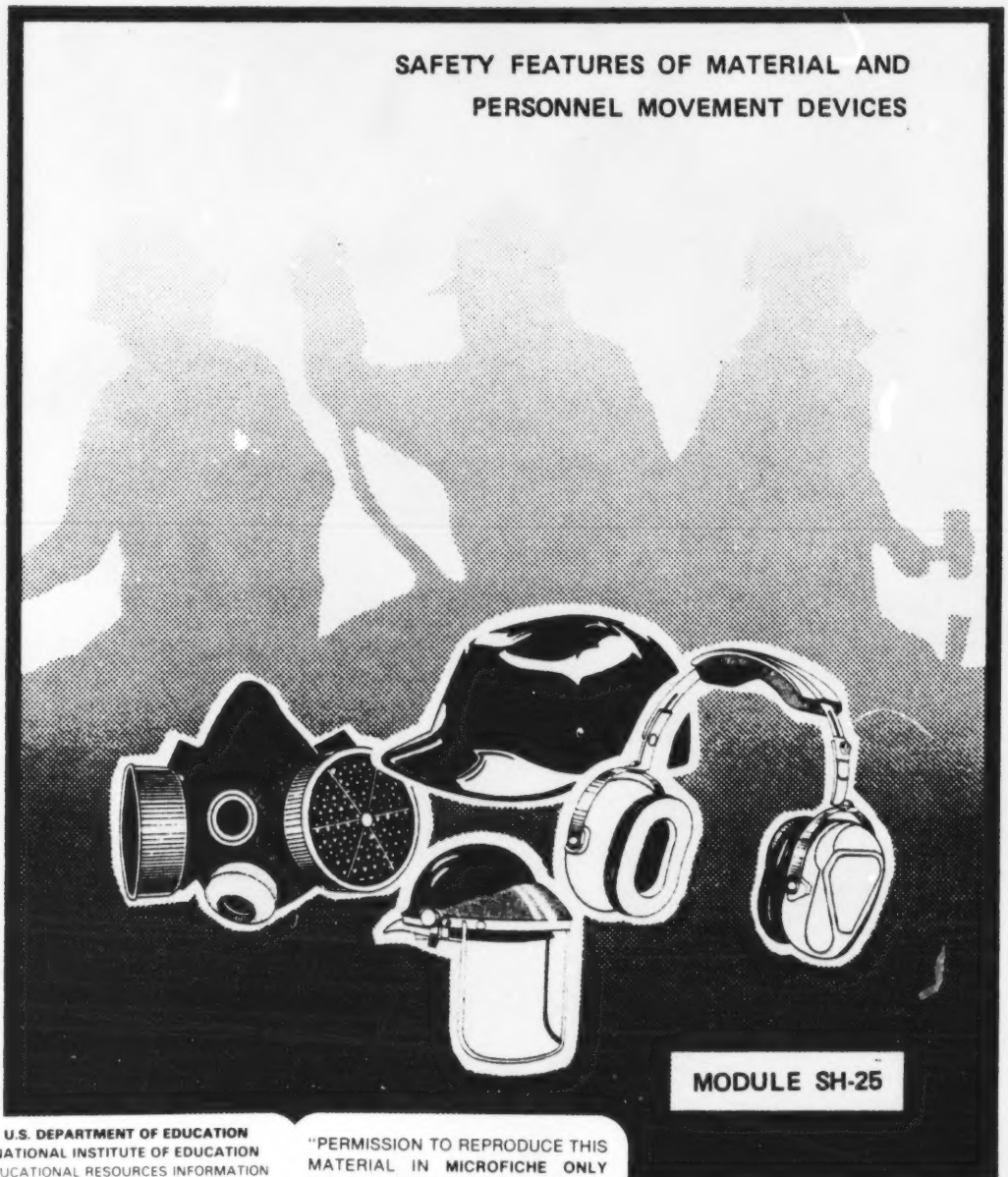
ED213859

SAFETY AND HEALTH

SAFETY FEATURES OF MATERIAL AND PERSONNEL MOVEMENT DEVICES



MODULE SH-25

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INTRODUCTION

Unfortunately, simply being in favor of safety is not enough to prevent accidents. Concern for safety must be translated into action on the part of industry and workers. Unsafe acts and unsafe conditions must be understood as measurable; only then can accidents be eliminated.

Elevators and other material and personnel movement devices are built according to established guidelines. Safe usage of these devices depends on lawful construction, regular maintainance, and proper operating procedures. No device is completely safe unless it is being operated by someone who has studied and learned the guidelines that govern its use. The trained operator who is in command of the device must understand its capabilities and limitations.

Besides taking a toll on human life and health, the malfunction of material and personnel movement devices can be very costly in terms of production loss and repair or replacement expenditures. Property damage may not be limited to the movement device itself; whole buildings can be destroyed by a fire, an explosion, or a collapse that is initiated by a seemingly minor accident.

Accidents are extremely expensive in terms of human life and health, property, and productivity. The impact of a serious accident on an employee and his or her family, co-workers, and company is so great as to be difficult to measure. Safety is not only a humane choice but an economically practical one.

The use of personnel and material movement devices is economically essential in modern production operations. With these devices come increased opportunities for accidents, so safe procedures for operating them and for working in their vicinity are necessary.

This module covers safe conditions and operating practices for conveyors, elevators, escalators, moving walks, manlifts, forklifts, motorized hand trucks, and aerial bucket devices.

OBJECTIVES

Upon completion of this module, the student should be able to:

1. List four hazards characteristic of conveyors and some precautions that aid in conveyor safety. (Page 3)
2. List three devices to provide operator safety on lift trucks. (Page 6)
3. Name two safety features of a motorized hand truck and describe how these devices work. (Page 9)
4. Identify the types and functions of safety features that are provided on traction and hydraulic elevators. (Page 11)
5. Name at least two safety features of a freight elevator. (Page 14)
6. Name six visible safety features on escalators. (Page 16)
7. Identify at least two safety features of moving walkways. (Page 18)
8. List six main operating rules of a manlift. (Page 20)
9. List nine safety procedures for aerial bucket devices. (Page 25)
10. State the procedures for and frequency of inspections of personnel movement devices. (Page 27)

OBJECTIVE 1: List four hazards characteristic of conveyors and some precautions that aid in conveyor safety.

The device that has done much to revolutionize materials handling is the conveyor. This is due to the conveyor's ability to move large quantities of material efficiently. The most common conveyors are belt-type conveyors, chain conveyors, and bucket conveyors, all of which may be either mobile or fixed. There are other types of conveyors less commonly used; these are the types with platforms and wheel conveyors. There is also a screw conveyor that moves grain and bulk material to location by means of a screw inside a container. Since conveyors can be hazardous, mechanical guards are provided to protect the operating personnel, as well as those in the vicinity. The loading point, the transfer points, and the discharge points of conveyors must all be guarded to prevent objects falling off the conveyor and hitting workers who may be in the surrounding area. Figure 1 shows a cross section of a conveyor, with guards on each side.

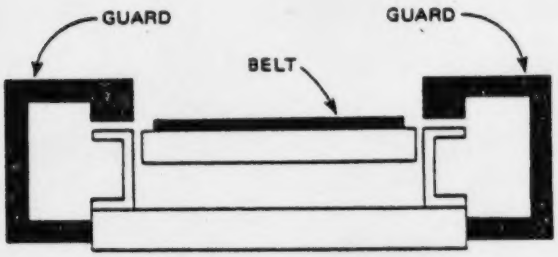

Figure 1. Conveyor guards.

Workers must also be aware of "nip points" on conveyors. These hazards are created by one or more rotating parts on the conveyor. A nip point is formed whenever a part rotates over, under, or near a stationary object. This hazard is formed on a conveyor when the belt or chain rotates around the sprocket or pulley. See Figure 2. Another kind of hazard is known as a shear point; these points are sometimes located where the conveying mechanism runs close to a stationary object or to a guard. Nip point and shear point guards are not required for overhead conveyors that are more than seven feet above the floor. In areas restricted

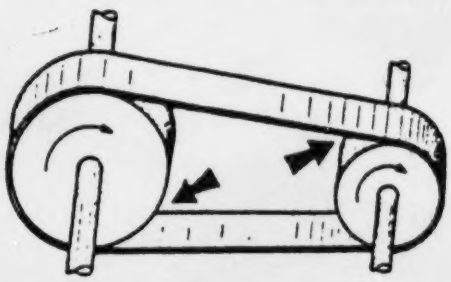

Figure 2. Example of nip points.

from the traffic of the general public, where workers are familiar with the surrounding area, such guards are not required, either — areas that are not guarded should have signs stating that there is a hazard in the area, to alert workers that the hazard exists. Guards should be provided where conveyors pass over roads, walkways, and work areas, to prevent objects from falling on workers underneath.

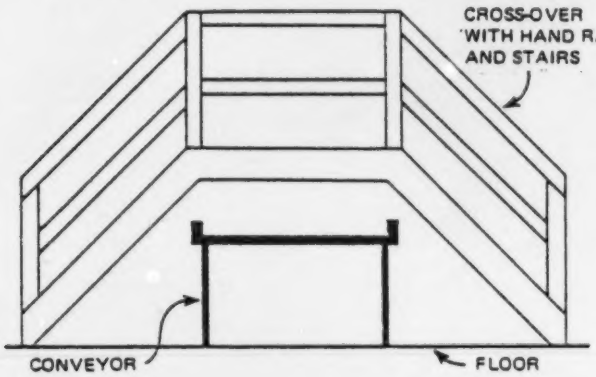

Figure 3. Crosswalk over conveyor belt.

Conveyors of extended length require a means of passing from one side to the other. Since walking on a conveyor is very unsafe, crossovers are provided to allow safe passage from one side to the other. Crossovers may be either stairs or ladders coming from each side of the conveyor and connected by a crosswalk (see Figure 3).

Where conveyors pass through building floors, the openings should be guarded by handrails and toeboards. Automatically-closing fire doors should be provided where conveyors pass through a building floor or through a fire wall.

Conveyors appear to be simple devices, but workers should be trained in their proper use. Such training should include starting and stopping procedures as well as the use of the emergency devices provided on each conveyor system. In the recognized procedure for loading and unloading, workers must stand clear of the conveyor so that feet and hands will not get entangled in the conveying device.

A central control station with a good view of the conveyor provides the means for starting and stopping the conveyor system. If the system has transfer points to feed the flow of material from one conveyor to another, the operation of the gates involved may be electrically controlled at the central station.

Conveyors situated where they may cause injury to workers should have a warning system to notify all personnel in the area that the conveyor is about to start. The power-operated conveyor must have emergency stop devices located along the travel of the conveyor, particularly if it travels long distances. Whenever these emergency devices are actuated, they must be manually reset. The cause of the stoppage should be determined and cleared before the conveyor is restarted. For the safe operation of a conveyor, the operator should have clear access to the start and stop switches. All areas around loading and unloading points should be cleared of obstructions to prevent any danger to workers.

Lubrication of any mechanical device is necessary. The procedure for lubricating a conveyor is (1) turn the conveyor off and lock the controls; (2) locate all the lubrication points on the conveyor and lubricate each one in the proper manner. This should include the bearings of the rollers that are under belt devices, chain rollers, and the motor itself. The purpose of lubrication is to extend the life of the conveyor so that it will perform its job and make the moving of materials easier for everyone. Safety devices are on the conveyor for the protection of personnel, so the third step is to check these devices to see that they are working properly and that the guards are properly located.

ACTIVITY 1:*

1. Name five locations on a conveyor where guarding may be necessary.
   a. _____
   b. _____
   c. _____
   d. _____
   e. _____
2. When an emergency stop device on a conveyor actuates, what must be done before the conveyor is manually reset? _____
   _____

*Answers to Activities appear on page 30.

OBJECTIVE 2: List three devices to provide operator safety on lift trucks.

Power lift trucks, called industrial or forklift trucks, have been in use for many years. During this period of time it has become apparent that certain safety features for the protection of the operator needed to be designed into the trucks. Safety features are now incorporated into most industrial trucks. For example, an overhead guard, placed above the operator's cab or seat, protects the operator from falling objects. This guard deflects or stops small objects, but it is not designed to cope with the fall of a full load. Thus, it is important for the operator to exercise great care with any load being lifted. To further protect the operator, the carriage (load elevating assembly) should be equipped with a load backrest. For high lifts, there should be an extension on this load backrest to provide additional protection from objects that might fall from the lifted load. The lifting mechanism should be designed to prevent the carriage from being raised too far on the mast. (The two vertical beams of the mast support the carriage and contain the hoisting mechanism.) One of the significant improvements incorporated into the design of lift trucks is a mast that is capable of being tilted forward and backwards while being raised and lowered. In all lifting operations, the mast should be tilted backwards slightly so that the load will not fall forward off the forks. Only when the load is being placed in the required position in a stack, should the mast be tilted forward.

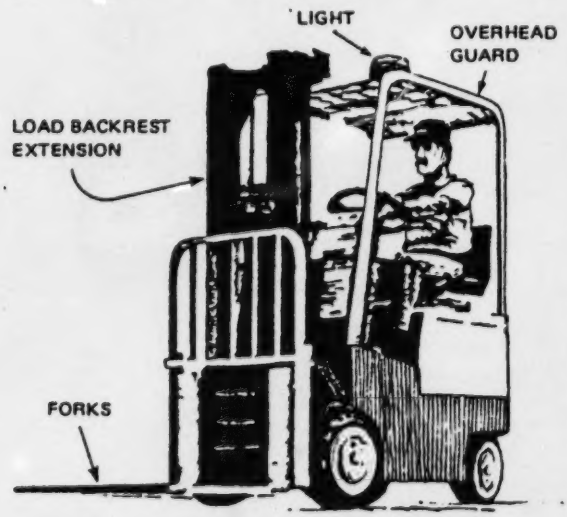

Figure 4. Forklift truck.

Lift trucks are now required to be equipped with a horn for warning people of the movement of the truck. Also, lift trucks are frequently equipped with a flashing light to give visible warning of the truck's approach and location. Figure 4 shows the overhead guard, load backrest extension,

mast, and general appearance of the lift truck.

Only trained and authorized operators are allowed to operate lift trucks. Lift truck manufacturers can often supply the materials for a good training program that includes safety procedures. This program, along with special instructions for the employers' specific needs, ensures that the operator is competent in the basic operation of the lift truck. Each operator training course should include information on the following truck operations:

- Inspecting the truck prior to use.
- The function and proper use of truck controls.
- General truck loading practices.
- Loading and unloading highway trucks and trailers.
- Loading and unloading railroad cars.
- Traveling speeds.
- Cornering speeds.
- The importance of adequate clearance and of looking in the direction of travel.
- Working in hazardous environments or with hazardous materials.
- Precautions when leaving a truck unattended.
- Refueling and recharging operations.
- The procedure to follow when truck defects are found.
- Driving near pedestrians.
- How to determine if a load is safe to handle.
- Specific hazards of the trainee's prospective tasks in the plant.

Hazardous operations that may contribute to an accident must be recognized and avoided. Driving up to a person who is in front of a fixed object may result in that person's being pinned to the object. A person passing under a raised fork may be struck by the fork if it is lowered by an operator who does not see the person. Unauthorized riders may fall off the truck or become wedged between the truck and an obstruction. Operators may lose an arm or a leg if limbs are placed between the mast and the outside edge of the lift truck while it is in operation.

When the operator of a lift truck dismounts, the load must be fully lowered, the truck controls neutralized, and the brakes set. If the operator moves more than 25 feet from the vehicle, or if the truck is not in view, it is considered unattended and the power must be shut off. The wheels should

always be blocked when the operator dismounts with the lift truck on an incline.

A careful lift truck operator will check overhead clearances to be sure that the load or mast will not strike lights, pipes, sprinklers, beams, or low door openings. The lift truck should not be parked in fire aisles, in passageways to stairs or anywhere it will block fire equipment. While operating the lift truck, the operator should always look in the direction of travel. At cross aisles or places where vision is obstructed, the truck should be slowed and the horn sounded. Grades and inclines above 10% should be ascended and descended at a slow speed. Under all conditions, the lift truck should be operated at a speed that will permit stopping for emergencies. Horseplay or stunt driving is prohibited, as serious damage or injury can result. It has proven to be safest to drive up a grade with the load toward the grade. Unloaded trucks should be driven with the forks on the down-grade side. Wet and slippery floors are dangerous and necessitate slowing down. Lift truck operators should make sure that dockboards and bridgeplates are securely fastened before driving them. (Dockboards or bridgeplates are devices that allow smooth passage from a dock to a vehicle.) A lift truck operator should approach an elevator with care, making sure it is level with the floor before driving into it. Once in the elevator, the operator should lower the fork to the floor, neutralize the controls, shut off the power, and set the brake.

There may be times when the lift truck is used to elevate a person. When this is so, a safety platform secured to the lifting carriage (or forks) should be used, and a means provided for the person on the platform to shut off the power on the truck. Lift trucks are rated to lift and carry a specified weight — so the appropriate truck should always be used.

A lift truck operator should inspect the truck before starting a new shift. If the lift truck is found to be unsafe in any way, it should be taken out of service until it has been restored to safe operating condition. Repairs must be made only by trained and authorized personnel.

ACTIVITY 2:

1. (Mark these statements true or false.)

   ____ a. Lift trucks must be equipped with a horn.

   ____ b. The mast of a lift truck should always be tilted slightly forward.

   ____ c. Dockplates should be securely fastened before a vehicle drives over them.

   ____ d. If a lift truck operator checks his or her truck and finds something needing repair, he or she should immediately make repairs on it.

2. (Fill in the blank.)

   a. When the operator of a lift truck dismounts, the load must be _____ _____.

   b. If the operator is more than _____ feet away from the vehicle, it is considered unattended.

   c. When a lift truck is used to lift a person, a _____ _____ should be secured to the lifting carriage.

   d. Three safety devices on a powered industrial truck are the _____, _____, and _____.

OBJECTIVE 3: Name two safety features of a motorized hand truck and describe how these devices work.

A motorized hand truck, also known as a pallet truck, is designed to lift a load by elevating the forks only slightly above the floor. The lift of the forks is generally less than six inches. Loads to be transported are placed on pallets which allow the forks to run over the lower part of the pallet while getting the forks under the load.

Some motorized hand trucks are designed to allow the operator to ride, but most are equipped with a steering handle used as the operator walks

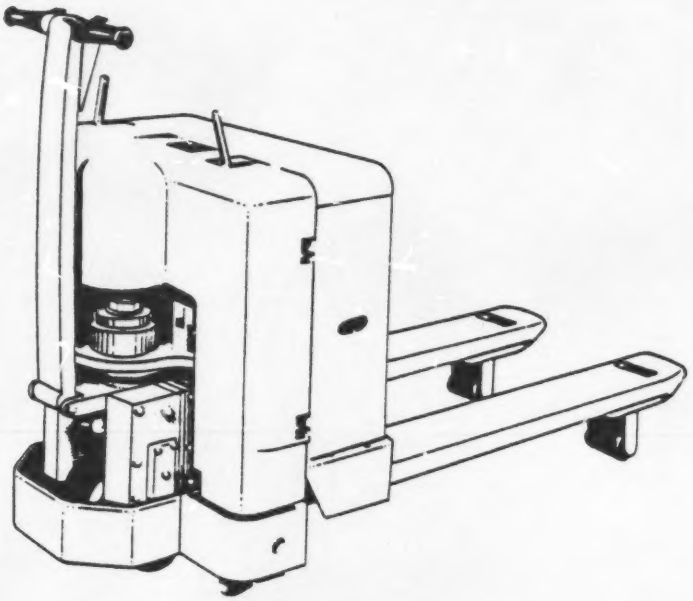

Figure 5. Motorized hand truck.

in front. The operator should lead the motorized hand truck, except in confined areas where the operator could be pinned between the hand truck and another object.

Certain safety devices help to make operating a motorized hand truck safe. In a normal operating procedure the operator will push a button on the handle for forward or reverse gears. When this button is released the truck will stop, the power will be turned off, and the brakes will be automatically set. Another safety device is that the controlling handle automatically returns to the upright position when released. The power remains shut off and the brakes are set any time the handle is in an upright position.

Additional safety features include lights and horns to warn of the truck's approach, and metal hand guards on the operating handle.

Motorized hand trucks are powerful machines, and operating them requires caution. Unauthorized riders must not be allowed and the machines should be used only for the purposes for which they are designed.

ACTIVITY 3:

1. Complete the following statements.
   a. A motorized hand truck is designed to lift a load by _____ _____.
   b. In a normal operating procedure, the operation of a pallet truck will push _____ _____.

2. Should an operator lead or follow a motorized hand truck in confined areas? _____

3. Briefly describe two automatic safety features built into a motorized hand truck.

   a. _____

   b. _____

OBJECTIVE 4: Identify the types and functions of safety features that are provided on traction and hydraulic elevators.

Today's modern elevators can be divided into two categories — the hydraulic elevator and the traction elevator. (See Figures 6 and 7.) The hydraulic

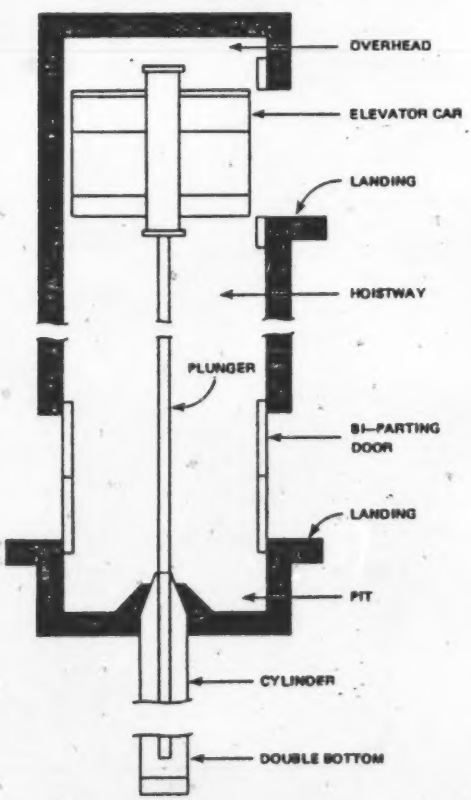

Figure 6. Hydraulic elevator.

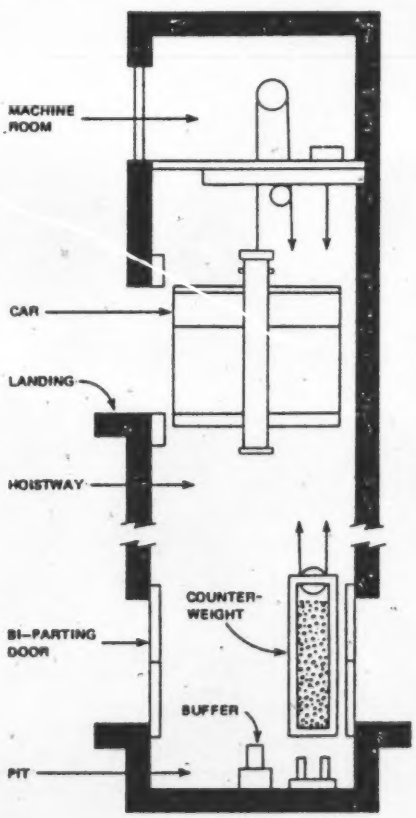

Figure 7. Traction elevator.

elevator (Figure 6) is moved by a plunger that is driven by oil being pumped into a cylinder. The traction elevator (Figure 7) is a car connected to a counterweight by steel ropes. These ropes are wound around a grooved drive sheave that supplies the traction, or friction, necessary to move the elevator. The rope itself is not directly attached to the driving motor; rather, the driving motor rotates the driving sheave.

Passenger elevators are manufactured and installed to offer one of the safest means of transportation available. The structural safety requirements of the material used in elevator manufacture is many times the minimum strength required. Thus, the chances of a part breaking and causing an injury is very small. Most injuries involving an elevator are caused by its improper use, either unintentional, or purposeful.

Many safety features are found on both hydraulic and traction elevators. The car in which the passenger rides is made of rigid material, is fire-resistant and has limited openings. The car doors are smooth panel doors that are automatically opened and closed. To protect the passengers from being struck by the doors, a safety device is provided that will stop and/or reverse the doors upon actuation. The doors close with a limited force to reduce possible injury. Inside the car, adequate lighting is provided, and newer elevators have emergency lights to provide illumination during power failures. Lighting is so important that more recent building codes require a key-operated switch to prevent pranksters from turning lights off.

The car's operating panel contains the buttons or switches for the passenger's use in operating the elevator. A button for each floor, when pushed, sends the elevator to that floor. A "door open" button holds the doors open, or stops and reverses the doors if they are closing. An alarm or emergency call button is provided to alert persons outside the elevator of an emergency, by sounding a loud bell. The emergency stop button or switch should be red, or have a red lever. When actuated, this stop button will remove all power from the elevator, thereby preventing it from moving. When all power is off, the brake is set, and the power is removed from the door operating device.

The shaft in which the elevator travels is called the hoistway. It is constructed of fire-resistant material, usually required to withstand a fire for two hours. The hoistway doors (those not on the car) are tested for fire-

resistance as is all required hardware. Hoistway door panels are smooth in order to prevent injury by contact with the doors while they are in motion. The hoistway doors are locked by mechanical means so that they cannot be operated unless the elevator car is at that door. The lock also has electrical contacts to prevent the elevator from moving while the door is open.

The clearance between the elevator floor and the building floor at the hoistway door opening is limited to a maximum of 1 1/2". This is to provide safe entry and exit from the elevator.

Hydraulic elevators have an additional set of safety features. The cylinder of newer elevators has a double bottom, one part of which has a small hole in it. The purpose of this double bottom is to allow the elevator to go down slowly in case the outside bottom rusts through or gets a hole in it for any reason. A manually-operated lowering valve is provided to let the elevator down in case of power failure or emergency, and a relief valve is provided to limit the amount of pressure to the cylinder.

To mitigate or prevent accidents caused by the elevator's going too high or too low, two additional safety features are provided. The plunger is equipped with a stop ring to prohibit the elevator from going too high, while below the car, spring buffers are provided to cushion the stopping of the elevator if it goes below the bottom floor.

Traction elevators (those with steel ropes and a counterweight) have manufacturing guidelines, also. Firstly, the rails that guide the elevator up and down are constructed of steel. The steel ropes that actually support the elevator are required to be tested to support four times the expected weight to be lifted.

Secondly, a governor prevents the elevator car from falling or from overspeeding. If the elevator car exceeds its normal design speed for any reason, a safety switch is activated and this sets the brake on the elevator's driving machine.

In addition, the machine that drives the elevator has a brake to stop the elevator. The brakes are automatically set when there is a power interruption, so that the elevator will not move. Below the car at the bottom landing, either spring or oil buffers are provided. Oil buffers are similar to shock absorbers on an automobile. The oil buffers are made of different

sizes to properly cushion the stopping of the elevator at higher speeds, if the elevator goes below the bottom floor. There are special limit switches at the top and bottom of the hoistway to make the elevators slow down and stop automatically.

There are many other safety features built into elevators to make them operate safely and smoothly. Safety must not only be designed into elevators, but must be practiced by operators and passengers, also. Persons riding elevators should remember that an elevator is electrical and mechanical. It will do only what it is built to do. Passengers must operate the elevator properly, entering and exiting safely. Passengers should take particular care to look for the safety devices that will keep the doors from closing on someone, rather than trying to force the doors open.

ACTIVITY 4:

1. List five safety features found on traction elevators.
   a. _____
   b. _____
   c. _____
   d. _____
   e. _____
2. Name one additional safety feature found on an hydraulic elevator, and explain the function of this feature. _____
   _____
3. What is the purpose of spring or oil buffers?
   _____
   _____

OBJECTIVE 5: Name at least two safety features of a freight elevator.

Freight elevators are used to move material and objects with or without an assigned operator on the elevator. Basic safety features are the same on

freight as on passenger elevators. The visible differences are as follows:

- The elevator car will normally be equipped with a gate that opens by moving upwards. This provides a greater width for loading operations.
- The hoistway doors are constructed of strong metal and will open with one half up and one half down.
- The elevator car gate and hoistway doors may or may not be power operated.
- A mnaual car gate is provided with both a handle and a pull strap to safely operate the gate.
- The manual hoistway doors (bi-parting — those which open one-half up and one-half down) are provided with a cushioned material on the closing edge to prevent injuries to the operator's hands.
- Power-operated car gates are limited in speed and may be equipped with a safety edge that will cause the gate to stop and reopen if it strikes an object.
- Freight elevators must be designed to carry much heavier loads than passenger elevators carry. They must also be built to withstand the heavy side thrusts and twisting forces caused by loading and unloading, particularly with power trucks. Heavy steel construction must be used in the manufacture of the car, and guiderails. must be fastened to the hoistway walls. Frequently, this fastening is done with heavy steel brackets.

The safe opening and closing of power-operated freight car gates and hoistway doors is dependent mostly upon the operator. The closing of the doors may be by continuous pressure on a close button that, if released, will stop and reopen the doors. If the doors close automatically, the car gate will close first, then the hoistway doors. The operation of the doors by power requires the operator to make sure that the entrance is clear before actuating the door closing button. Once the door closing button is actuated, the operator should continually observe the entrance to be sure that others do not try to enter. The operator should stop the door motion if others are in danger of being struck by the doors.

The capacity of a freight elevator and the type of loading permitted is posted in large letters and figures inside the elevator. An elevator must never be overloaded. All objects must be inside the elevator before the elevator is moved. The elevator must be level with the floor before loading or unloading is done.

When lift trucks are used, the elevator must be made to handle the truck. The elevator should be entered slowly and squarely when materials handling equipment is used.

Emergencies may arise on either passenger or freight elevators. If the elevator becomes inoperative while a person is in it, competent help should be summoned. An elevator mechanic can usually get the elevator to a floor so the person inside the elevator may leave normally. This may take a little time but it is the safest method. Should the person have to be removed when the elevator is not at a floor, the power must be turned off and necessary equipment to remove the person safely must be provided. Persons should only be removed from an elevator, other than on a floor, by trained personnel. Firemen are trained to remove passengers if an elevator mechanic is not available.

ACTIVITY 5:

1. How is capacity and loading indicated on a freight elevator? _____
2. What means are provided to operate a manual car gate? _____

OBJECTIVE 6: Name six visible safety features on escalators.

Escalators (Figure 8) have the capacity of moving large numbers of people in a short amount of time. The design of escalators has changed over the years to make them safer and easier to use. Escalators are equipped with a number of safety features that are visible to persons using them. Among these visible safety features are the following:

- The hand rail must travel in the same direction and at approximately the same speed as the steps. This allows a person to hold the hand rail (and all riders should hold the hand rail) for the entire length of the escalator, without having to let go and regrip the hand rail.

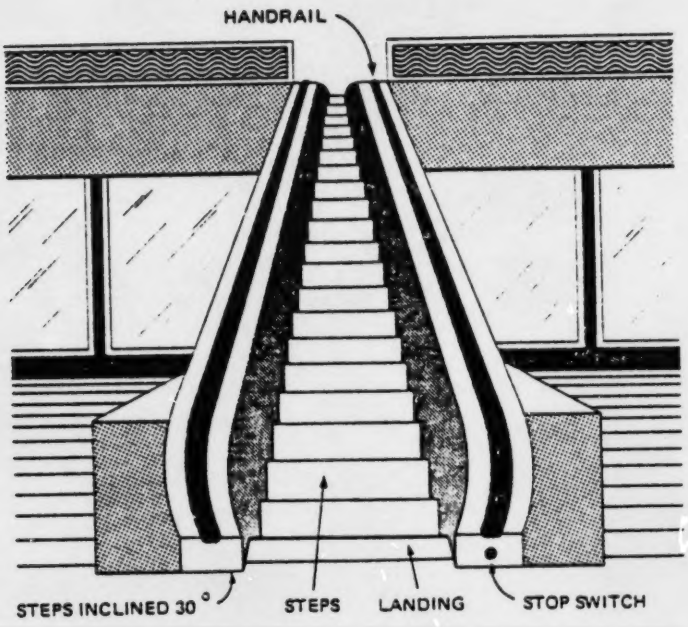

Figure 8. Escalator.

- The steps must be made with grooves that fit into grooves on the top and bottom landing area, so that objects will be pushed onto the landing with no damage.
- Hand or finger guards must be provided at the point where the hand rail enters a wall opening.
- An emergency stop button must be located at the top and bottom of the escalator and must be easily accessible.
- A guard must be provided when an escalator passes near a floor a or ceiling.
- A light should be located under the steps at the landing to make it easier to see the steps individually, as well as illumination on all tread surfaces.

Safety features built into an escalator but not seen by persons using them are as follows:

- A brake to stop the escalator when the power is off.
- Switches to shut off power if the drive chain becomes slack, or breaks.
- Switches to shut off power or stop the escalator if objects become wedged between the steps and the side panel.

- A speed-limiting mechanism known as a governor, to prevent the escalator from traveling faster than a pre-determined rate.
- A device to prevent a sudden reverse in direction of travel.
- The escalator, once stopped, can only be started with a key operator switch.

There are many safety features built into an escalator. The greatest safety factor is proper use of the escalator by the passenger or riders. Passengers should always stand firmly on the steps, hold the hand rail, and should ride facing the direction of travel. When the landing is reached, passengers should step off promptly.

ACTIVITY 6:

1. State the location of the emergency stop button on an escalator. _____

   _____

2. Why does the hand rail travel at the same speed as the steps? _____

   _____

3. List three unseen safety features on an escalator.

   a. _____

   b. _____

   c. _____

OBJECTIVE 7: Identify at least two safety features of moving walkways.

The moving walkway is comparatively new in people-moving equipment. The walkway is a device made to transport people between points on a flat or slight grade (up to a maximum of 15 degrees). The purpose is to move people with as little effort as possible in a rapid manner. Some moving walkways look like an escalator laid flat, while others look like a belt-type conveyor (see Figure 9). The visible safety features are similar to those of an escalator, due to the relatively similar makeup of the two types of equipment. The

Figure 9. Moving walkway (with incline from 0 to 15 degrees).

greatest use of moving sidewalks has been in airports, where large numbers of people are arriving and departing. Tight airline schedules often require that people move from one area to another in a minimum amount of time.

Safety features of moving sidewalks are as follows:

- The treadway should be grooved in the direction of travel.
- The landings should be made to receive the step tread so that the grooves pass a plate with sections that fit into the grooves, to push an object onto the landing with no damage.
- Driving devices must have brakes which automatically set and shut off power in case of malfunctions.
- The starting switch should be key-operated to prevent unauthorized use.
- Emergency stop buttons must be provided at each entrance and exit point of moving walkways, to stop movement in case of emergency.
- A switch must be provided to stop moving walkways in case a drive chain becomes slack or broken.
- A governor must be provided to stop moving walkways in case of overspeed.
- A device must be provided to stop the moving walkways in case the treadway breaks.

ACTIVITY 7:

1. When does the brake on a moving walkway set?

   _____

   _____

2. What is required to start moving walkways; and why? _____

   _____

OBJECTIVE 8: List six main operating rules of a man lift.

A man lift is a device consisting of a power-driven endless belt that moves in one direction only and is provided with steps or platforms. Hand holds are attached to it, and it is used for transportation of personnel from floor to floor (see Figure 10). A man lift is often found in manufacturing and storage buildings where there is a long distance to travel up and down. A properly equipped and installed man lift provides a safe, convenient, and space-saving access to upper levels.

The operating rules of a man lift are a very important part of its use and help to explain its safety features. The following rules apply to the use of a man lift:

1. Only authorized personnel trained in its use should be permitted to use a man lift.
2. Unsafe conditions on man lifts must be reported.
3. When riding a man lift, the passenger must stand squarely on the step, face the belt, and grip the hand hold securely. Jumping on the step, yanking on the hand hold, or horse play of any kind is prohibited.
4. No freight, packaged goods, pipe, lumber, or materials of any kind should be carried or transported on any man lift.
5. No tools except those that will fit entirely within the pocket of usual working clothes should be carried on any man lift.
6. Before starting or restarting a man lift, it is necessary to warn all passengers and others the vicinity that the man lift is to be started.

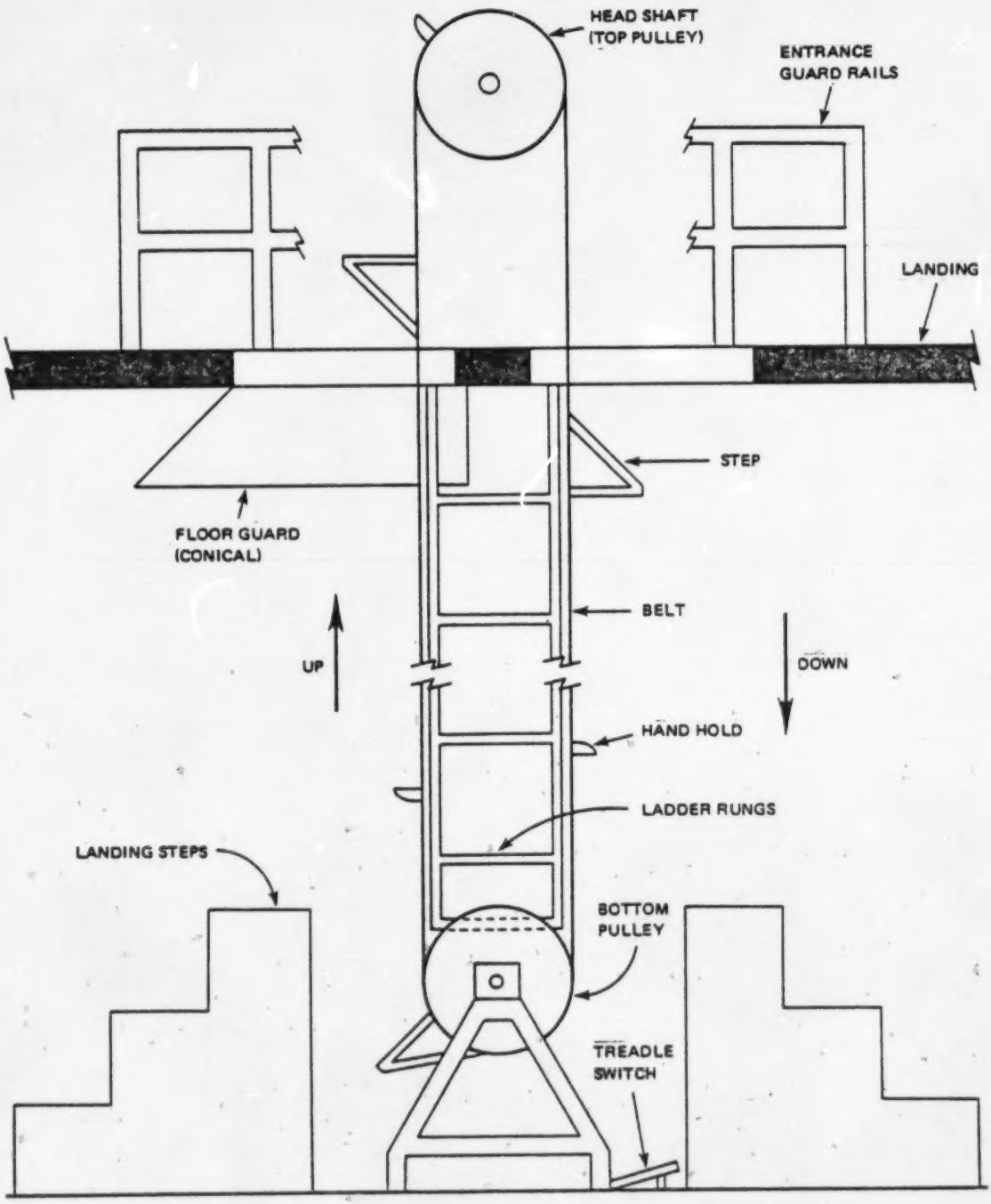

Figure 10. Man lift – top and bottom.

The floor openings that allow the belt to go up and down the building must be within a minimum and a maximum size. The minimum size allows the clearance of a person's body while the maximum clearance provides an easy step on and step off. Floor openings must be located in line, one above the other. At each landing, certain safety features are provided. Adequate lighting is one of these features and must be provided so that the floor landing can be seen when stepping on or off. The landing surfaces must be constructed and maintained to provide safe footing at all times. The maximum distance between landings must be 25 feet or less. If the floors are more than 25 feet apart, another landing for emergency purposes must be installed. Emergency landings, like all other landings, must be accessible from both up and down directions. This allows access to an emergency exit ladder that is provided for the entire travel of the man lift.

On the up side of the man lift floor, openings must be provided with a bevelled guard (or cone) to guide a body into the floor opening, in case someone is leaning out too far. There are other types of guards that are equipped with a switch to shut down the man lift if the switch is engaged by a body's touching it.

The floor landing must be equipped with guard rails at the entrances and exits. These guardrails must consist of a maze or staggered railing, or it may be equipped with a handrail with self-closing gates. These precautions are required so that direct passage to the man lift from the outer floor space is prohibited. Accidental contact with the belt and falls through the opening are thus prevented.

The total run of a man lift must be kept clear of any obstruction. If it is necessary to have an obstruction near the man lift, use of the man lift should be discontinued. At the lower landing, safety switches must be installed so that if a passenger travels past the lower landing, the man lift will stop.

The man lift must also be equipped at the upper landing with safety switches or devices that will stop the man lift if the passenger fails to get off. The upper landing must also have a sign which reads "TOP FLOOR – GET OFF" with letters at least two inches high. A red warning light of at least 40 watts must be located immediately below the upper landing terminal, located

to shine directly in the passenger's face. This warning light alerts passengers that the top landing is just ahead.

An emergency grab rail or railing platform must be provided at the top of the man lift where the distance to the top pulley is over six feet above the top landing. This rail will permit the rider to swing free, should the emergency stops become inoperable. In addition to the required lighting at floor landings, the man lift must be illuminated for its entire travel. The means of illumination must be controlled by one switch that will turn the lights on at every landing.

The machine powering the man lift must be equipped with a brake that is mechanically applied and electrically released. This type of brake will set if the power is turned off the machine. The safety switches located at the top and bottom in case of overtravel by passengers, must be manually reset to ensure that the problem has been corrected. Safety switches should be located so that they cannot be reset by a person standing on a man lift step.

A rope-controlled emergency stop device must be installed and must travel the full run of the man lift belt. This rope is to be located within easy reach of the up and down runs of the belt and must be provided with rope guides and pulley arrangements so that it will not have too much sideways movement. The rope is connected to a control lever or operating mechanism that will cut off the power and apply the brake, when pulled in the direction of travel.

The steps of the man lift must be strong enough to support a load of 400 pounds. Every step must have a hand hold for both the up and down travel of the man lift. If a step or hand hold is removed, the hand hold or step that it is used with must also be removed. This precaution prevents a passenger from grabbing a hand hold and having no step to stand on — or from standing on a step and having no hand hold to grasp.

Instructions and warning signs are required on every landing. The instructions for each lower landing must read approximately as follows: FACE THE BELT — USE THE HAND HOLD — TO STOP, PULL ROPE. A visitor's warning sign must be installed at each landing. The sign should read: AUTHORIZED PERSONNEL ONLY.

Man lifts must be regularly tested and inspected by a competent, designated person at intervals of not more than 30 days. The limit switches, or safety devices at the top and bottom of the man lift, should be checked at least weekly be a designated person. Man lifts found to be in unsafe condition must not be operated until properly repaired.

An inspection log must be kept. This log must outline what was found during the inspection, and must be signed and dated by the person designated. Records of the inspection must be made available to authorized inspection agencies. The periodic inspection should cover but not be limited to the following features:

- Belt and belt joints
- Bottom pulley clearance
- Bottom pulley take up
- Brake
- Drive coupling
- Driving mechanism
- Electrical switches
- Floor landings
- Guard rails
- Hand hold fastenings
- Illumination
- Safety switches
- Lubrication
- Motor
- Motor couplings
- Pulley bearings
- Pulley supports
- Rail supports and fastenings
- Rails and tracks
- Rollers and slides
- Rope control stops
- Steps
- Step fastenings
- Top pulleys

- Vibration and misalignment
- Warning signs and lights

ACTIVITY 8:

(Mark each statement true or false.)

_____ 1. Hand rails are required around floor landings of man lifts.

_____ 2. Safety switches are required at the top and bottom of man lifts.

_____ 3. Signs are required at every floor of a man lift.

_____ 4. The machine is not required to have a brake.

OBJECTIVE 9: List nine safety procedures for aerial bucket devices.

An aerial bucket device (Figure 11) is any vehicle-mounted device, telescoping or articulating, or both, that is used to position personnel. Aerial buckets may be constructed of metal, wood, or fiberglass-reinforced plastic. They may be either powered or manually operated. Aerial bucket devices are used in a variety of operations, but are used most extensively by electric power companies. They provide a safe, convenient, and practical method of positioning workers so they can perform work on overhead lines. In such instances aerial buckets must be insulated to prevent conduction of electricity. Other safety rules for aerial bucket devices include the following:

- Before aerial trucks are moved for travel, aerial devices must be secured in the lower traveling position. This is done by locking the device above the truck cab, or by any other equally effective means (such as a cradle that will prevent rotation of the aerial device).
- Lift controls must be tested prior to use each day, to determine that such controls are in safe working condition.
- Only trained personnel may operate an aerial lift.
- "Belting off" to adjacent poles, structures, or equipment while working from an aerial lift is not permitted. "Belting off" means attaching a rope to other structures for added stability.

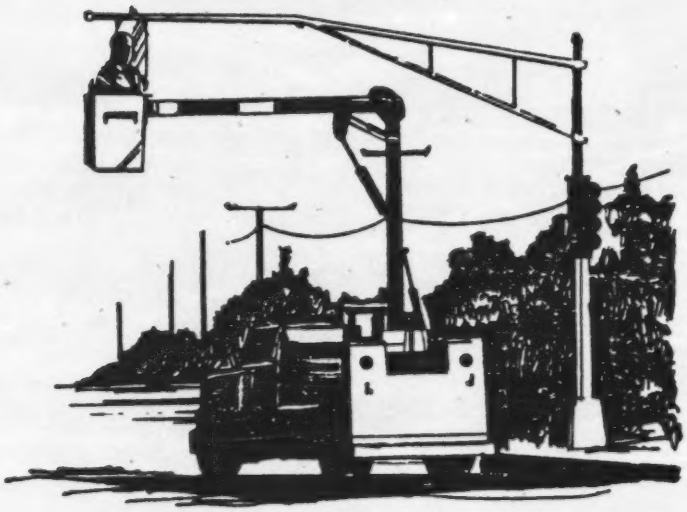

Figure 11. Aerial bucket device.

- Employees must always stand firmly on the floor of the basket, must not sit or climb on the edge of the basket or use planks, ladders, or other devices for a work position.
- A body belt must be worn, and a lanyard attached to the boom or basket, when working from an aerial lift.
- Boom and basket limits specified by the manufacturer must not be exceeded.
- Brakes must be set, and outriggers, when used, must be positioned on pads on a solid surface. Wheel chocks must be installed before using an aerial lift on an incline.
- An aerial lift truck may not be moved when the boom is elevated in a working position while personnel are on the basket. (Equipment especially designed for this type of operation is excepted from this rule.)

An aerial bucket designed primarily as a personnel carrier must have both upper and lower controls. Upper controls must be in or beside the bucket, within easy reach of the operator. Lower controls must be provided and must be capable of overriding the upper control. Controls must be plainly marked as to their operation. Lower level controls must not be operated unless permission has been obtained from the employee in the lift, except in an emergency.

Safety features of the aerial boom equipment have improved over the past few years. The booms and buckets are designed in such a way that the bucket is in an upright position at all times, and the boom only extends as far as can be safely carried by the vehicle upon which is is mounted. Extending a boom too far may cause the vehicle to tip or to turn over. For a longer reach on the boom, the vehicle is provided with outriggers. An outrigger is a device, fastened to the truck, which extends farther out than the truck's body. This allows more stability in the operation of the device. The controls on an aerial bucket are located so that they will not be accidentally engaged. They are the type that require constant pressure, so that if released, all motion will stop.

Aerial lift devices are required to be built and tested in accordance with federal standards. Thus, the operator knows that the equipment has been designed to withstand the load and to perform the service for which it is to be used.

ACTIVITY 9:

(Mark these statements true or false.)

_____ 1. An aerial bucket is a device hung by a rope.

_____ 2. An aerial bucket device is primarily for people, and has controls at the base and at the bucket.

_____ 3. An aerial bucket device has to be adjusted to maintain the bucket in an upright position.

_____ 4. Aerial bucket device controls turn themselves off if they are released.

OBJECTIVE 10: State the procedures for, and frequency of, inspections of personnel movement devices.

Every device that is used requires inspection and maintenance. A thorough inspection requires operating the equipment, as well as visually checking it, to make sure that it is in good working order. Maintenance of equipment means that it is being properly lubricated, adjusted and repaired. Preventive

maintenance performed before a breakdown can occur can save time, money, and may possibly prevent an accident. Preventive maintenance can be scheduled to be performed under ideal conditions, whereas breakdown conditions are rarely favorable. Inspection and maintenance of equipment is highly stressed by manufacturers, owners, and agencies responsible for safe operation of the equipment. The potential to decrease accidents and limit unnecessary costs warrants regular, thorough inspection.

The inspection and maintenance of material and personnel moving devices should be performed on a regular basis. Since lift trucks are often operated on a daily basis, and sometimes on a 24-hour basis, it is necessary for operators of these trucks to inspect their trucks before going on duty. This is also true of motorized hand trucks, which are not as complicated as lift trucks, but which still require inspection and maintenance. Only trained mechanics should carry out maintenance on either type of vehicle.

Elevators, escalators, and moving walks require inspections by trained personnel. Elevators are in very common use and the only items visible to the operator and passenger are usually the doors, the operating button, the cab in which a person rides, and the lights. Most of the equipment is located inside the elevator hoistway and in the machine room. Elevators are normally inspected to see that the equipment is not worn, that all electrical connections are correct, and that the elevator operates properly. An elevator requires a special test to make sure the safety devices are working. Safety devices are normally tested every 12 months, with no load in the elevator and at slow speed. Every five years, the safety devices are tested with a full load in the elevator and at full speed.

Escalators and moving walks are tested on a yearly basis to make sure that the operating buttons, emergency buttons, emergency stopping switches, governor, and other devices are in good working order. The step treads and landings are checked to be sure they are in good condition and then the internal parts of the escalator are inspected and lubricated. Since the escalator is running continuously, there is no practical means of getting into the escalator unless parts are removed.

The inspection and maintenance of a man lift is covered in Objective 8. It is particularly important that inspections of a man lift be made every

30 days. However, limit switches should be checked every seven days. A log of these inspections must be maintained. The maintenance on the man lift requires that it be properly lubricated, that the wiring and signs be maintained, that safety switches be kept operable at all times, and that the required guards be in place.

The inspection of aerial buckets should be made on a daily basis. The insulated portions of aerial buckets should be checked on a routine basis for damage, and at certain intervals, should be checked to make sure that insulation is not shorting out. Hydraulic lines should be checked for leakage and any detection of oil around the mechanism should be noted and reported for repair, if necessary.

ACTIVITY 10:

1. What two steps does a thorough inspection procedure involve?

   a. _____

   b. _____

2. Why are regular, thorough inspections a good idea?

   _____

   _____

3. How often should lift trucks be inspected, and by whom?

   _____

REFERENCES

American National Standards Institute. Safety Standards for Manlifts. American National Standards Institute A90.1, New York: 1976.

_____. Safety Standards for Conveyors and Related Equipment. American National Standards Institute B20.1, New York: 1976.

U.S. Department of Labor. General Industry Standards. Revised March 1, 1979 OSH Standards (29 CFR 1910).

ANSWERS TO ACTIVITIES

ACTIVITY 1

1. a. Loading points.
   b. Transfer points.
   c. Discharge points.
   d. The area around rollers, pulleys, or belts.
   e. Shear points where belt is close the wall.
2. The cause of stoppage should be determined and cleared.

ACTIVITY 2

1. a. True.
   b. False.
   c. True.
   d. False.
3. a. Fully lowered.
   b. Twenty-five.
   c. Safety platform.
   d. (Any three.)
      Horn, light, overhead guard, load brackrest and extension.

ACTIVITY 3

1. a. Elevating the forks only slightly above the floor; the forks run over the lower part of the pallet while getting the forks under the load.
   b. A button on the handle for forward or reverse gears.
2. An operator should follow a motorized hand truck in confined areas.
3. a. At any time the operating buttons or controlling handles are released, the vehicle will automatically stop, the power will be turned off and the brakes set.
   b. The controlling handle automatically returns to the upright position.

ACTIVITY 4

1. a. The passenger car is made of rigid, fire-resistant material.
   b. The car doors are smooth panel doors and automatically open and close.
   c. A safety device stops and/or reverses the door's opening to prevent people from being struck by the door.
   d. Doors close with a limited force.
   e. An alarm or emergency call bell is provided for emergencies.

f. An emergency stop button will remove power from the elevator and set the brake.

g. The elevator shaft (hoistway) is fire-resistant.

h. The hoistway doors are fire-resistant.

i. The hoistway doors will not open unless the elevator car is at that door.

2. (Any one.)

The cylinder has a double bottom, one part of which has a small hole. Thus, the elevator will br lowered slowly if the outside bottom rusts through.

A manually-operated lowering valve is provided to let the elevator down in case of power failure or emergency.

A relief valve is provided to limit the amount of pressure to the cylinder.

3. Spring or oil buffers cushion the stopping of the elevator.

ACTIVITY 5

1. Capacity and loading specifications are posted inside the elevator in large letters.
2. A handle and a pull strap.

ACTIVITY 6

1. At the top and bottom of the escalator.
2. So that the person using the escalator will not be pulled along by the rail and will not have to let go and regrip the rail.
3. Any three of the second bulleted list (of six) on pages 17 and 18.

ACTIVITY 7

1. When power is off.
2. A key; to prevent unauthorized use.

ACTIVITY 8

1. True.
2. True.
3. True.
4. False.

ACTIVITY 9

1. False.
2. True.
3. False.
4. True.

ACTIVITY 10

1. a. Visual inspection.
   b. Operating the equipment.
2. Because of their potential to decrease accidents and limit unnecessary costs.
3. Daily, at the beginning of each shift; by operators.